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⑫ 実用新案公報(Y2)

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⑳ 考 案 者 大 内 輝 雄 埼玉県川越市上戸新町35番地10

㉑ 考 案 者 林 正 治 埼玉県和光市本町10番地28号

㉒ 考 案 者 星 野 隆 一 埼玉県川越市熊野町17番地14号

㉓ 出 願 人 株式会社メドス研究所 東京都板橋区大山町1番1号

㉔ 代 理 人 弁理士 吉 村 悟

㉕ 審 査 官 石 井 良 夫

㉖ 参 考 文 献 特開 昭53-5645 (JP, A)

特開 昭57-136432 (JP, A)

実開 昭56-36302 (JP, U)

実開 昭50-5489 (JP, U)

実開 昭49-127280 (JP, U)

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⑳ 実用新案登録請求の範囲

先端部構成部2とこれに隣接した彎曲部4を含む長尺の挿入部Aを有し、この挿入部Aの内部に、その外側を薄肉チューブにより被覆した光学繊維束を配置してなる内視鏡において、上記光学繊維束を被覆する上記薄肉チューブの外側に、上記彎曲部4の長さに相当する部分だけ上記薄肉チューブと密接させて別の合成材被膜により重ねて被覆したことを特徴とする内視鏡。

考案の詳細な説明

本考案は、体腔内に挿入される内視鏡の挿入部のうち彎曲部における光学繊維束の折損を減少させた内視鏡に関する。

医療用内視鏡においては、これを患者の体腔内に挿入する際の患者の苦痛を極力軽減することが要求される。そのために挿入部の外径は、たとえ0.1mmであつても細くすることが望ましい。従つて、挿入部に導通される光学繊維束も細いほうが望ましいが、観察視野を確保する必要上、それには限度があり、このため、その外装を可能な限り薄くすることが要求される。

図面を参照して以下説明すると、従来は、その外装として肉厚0.1~0.2mm程度のシリコンチューブ、ゴムチューブ或いはプラスチックチューブ等

の可撓性の薄肉チューブ15が用いられてきた(第5図参照)。一方、このように外径を略極限まで細くした挿入部Aには、像伝達用及び照明用の各光学繊維束7、8のほか、鉗子等の生検具を挿通するための生検具挿通用チャンネル9、送気及び送水用の各チャンネル10、11、先端彎曲部を彎曲操作するための操作ワイヤ12等が内蔵されている。このように多種類の内蔵物を限られた空間に収納するため、各内蔵物は甚しく過密な状態で収納されており、その結果、光学繊維束等の内蔵物は、先端彎曲部4が彎曲する度に彎曲部4及び可撓管3内で互いに摺動し合い、相互的な押圧を繰返すといった現象を生じている。

通常、内視鏡の彎曲部4は第2図に図示するように、複数の短管5をかしめピン6等によつて順次連結して構成され、短管5に設けた挿通溝縁13を彎曲操作のための案内ワイヤ12が通っている。彎曲の中立軸は彎曲部の中心軸線上にあるため、彎曲時には彎曲の曲率中心に近い側即ち内周側では内蔵物の通過経路が短くなり、遠い側即ち外周側では内蔵物の通過経路が長くなる。これにより、内蔵物は近い側では圧縮を受け、遠い側では引張りの力を受ける。そのために、圧縮を受ける内蔵物は、経路の長い外周側に移動するか、操

作部側にずれていく。また、引張りを受ける内蔵物は経路の短い内周側に移動しようとして内周側にある他の内蔵物を押圧する。特に、鉗子等生検具を挿通するための生検具挿通用チャンネル9のような硬いチューブは、曲り難いので直線に近い状態を保とうとして、第3図に図示するように、矢印方向へ移動し、各光学繊維束7、8を押圧する傾向があつた。また同じ内周側にあるものでも、各内蔵物は、中心線からの距離によつて互いにその移動量が異なるため、各内蔵物間で相互に摺動を生ずることになる。

このようにして光学繊維束は圧縮、引張り、押圧等の力を受ける。この場合、圧縮力を解消するために光学繊維束の経路を変えても、他の内蔵物に対する押圧力を増加させるだけで必ずしも有益な手段とはならない。従つて、この押圧力を軽減させるためには、操作部1の方向に向けて光学繊維束を移動させ得るようにすることが最も望ましい。然し、挿入部A内を内蔵物が移動する際に、移動する内蔵物と管壁及び他の内蔵物との間に、通常50~200 μ 程度の摩擦があるので、この摩擦を克服するだけの力で押さなければ内蔵物は後退しない。また、その力によつて光学繊維束が左右に折れ曲つたり、座屈するようでは力が伝わらず、所要の移動が行なわれない。

薄肉チューブ15を外装した光学繊維束では、軸線方向に直交する力に対する強度が不足で、所謂腰が弱すぎて、押圧によつて潰れたり、圧縮時に座屈を起こしたりすることがある。それによつて光学繊維束は、彎曲部4の挿入部内で折れ曲り、S字状に蛇行し、光学繊維束を形成している個々の光学単繊維が折れてしまうこともある。

そのために、挿入部先端彎曲部4に位置する光学繊維束は、シリコンチューブ等の薄肉チューブ15で外装した上に更に薄肉の螺旋管を被せる方法が従来試みられた。然しながらこの方法では彎曲操作ワイヤの挿通溝縁13の内側に突出した部分が光学繊維束を保護する螺旋管の隙間に落込んで光学繊維を折ってしまうこともあつた。またこの螺旋管のエッジが、他の内蔵物例えば送気送水用のチューブ10、11と擦れあううちに、該チューブ10、11を切断してしまうといった故障もあつた。さらに螺旋管は短管5の端部や挿通溝縁13と引掛り易いので光学繊維束の挿入抵抗

が増加して、彎曲時に光学繊維束7、8は、内蔵物の抵抗に抗して光学繊維束を操作部側へ押し戻す力に耐えられないために移動することが出来ない。その結果、彎曲操作の度に光学繊維束は先端構成部2の側へ徐々に手繰り寄せられるように移動し、先端彎曲部で圧縮を受けS字状に蛇行し光学繊維束の折損の傾向が助長された。

本考案は、上記の諸問題を解決する為になされたものであり、内視鏡挿入部Aの挿入性を犠牲にすることなく、光学繊維束の折損を減少させた内視鏡を提供しようとするものである。

以下、添付した図面に示した望ましい実施例に従い本考案の構成を詳述する。

第1図は内視鏡の外観を示す図である。1は操作部であり、Aは体腔内に挿入される挿入部を示す。挿入部は先端構成部2、彎曲部4、可撓管3から成っている。彎曲部4の挿通管の構成は、第2図に示すように、側縁をきりそいだ短管5をかしめピン6によつて順次連結し、屈曲自在になしである。また該彎曲部4の内部には第4図に示すように像伝達用光学繊維束7、照明用光学繊維束8、生検具挿通用チャンネル9、送気用チャンネル10、送水用チャンネル11、彎曲部4を彎曲させるための操作ワイヤ12等が挿通されている。

像伝達用光学繊維束7、照明用光学繊維束8は第5図に示すように、その両端部を環状の口金14で固着されており、その中間部はシリコンチューブ、ゴムチューブ、プラスチックチューブ等可撓性の薄肉チューブ15によつて被覆され、該チューブ15の両端は前記口金14に糸で締着されるか、接着される。

本考案に係る内視鏡では彎曲部4に相当する部分において薄肉チューブ15の他に、合成樹脂材料その他合成ゴム等の被覆層によつて光学繊維束を被覆し、彎曲部においてのみ被覆を二重とし、その厚みを増加させ、腰を強くする。この様な被覆の方法としては、エマルジョンタイプの合成ゴム或いは合成樹脂にディッピングさせ該薄肉チューブに架橋被膜或いは凝固被膜を形成させたり、ペースト状の合成樹脂を塗布しダイス等によつて肉厚を均一にしごいて凝固させる等の方法が採られる。また本実施例では全体を被覆する薄肉チューブ15の上に被覆層16を部分的に被せている

が、逆に部分的な被覆層 16 の上に全体を被覆する薄肉チューブ 15 を被せてもよい。また上記の被覆を行なった光学繊維束の外表面に二硫化モリブデン、シリコン、テフロン等の表面潤滑剤を塗布すれば、内蔵物相互の摩擦抵抗も減少し、弯曲操作時にも経路の変化に対して円滑に該光学繊維束が移動するので、光学繊維束を座屈させず、また次第に S 字状に屈曲させてしまうといった欠陥も防ぎ得る。この潤滑剤の塗布は内蔵物相互の摩擦が発生する他の部分においても有効であるが、大きな弯曲を生じる弯曲部分において特に有効であり、上述した被覆と共に用いられることによつてその効果は一層大きくなる。

上記構成を有する本願考案に係る内視鏡によれば、光学繊維束 7、8 の全長に亘つて外装されているチューブ 15 は薄肉であり、光学繊維束 7、8 に対しては、その弯曲部 4 に相当する部分にのみ合成樹脂または合成ゴム等の被覆層 16 を具えているので、大部分の体腔内挿入部 A の外径は従来の内視鏡挿入部殆んど変わらず挿入性に与える影響は極めて少ない。また、部分的な肉厚の増加によつて腰が強くなり、外圧にも強く、また他の内蔵物或いはワイヤ 12 の挿通溝縁 13 の突起等による押圧にも耐え、弯曲時の経路変化によつて

生じる圧縮力を以つて光学繊維束を操作部 1 側に押出す力に変えることが可能となり、弯曲部 4 の部分における屈曲 S 字状の蛇行等も発生せず、光学繊維束 7、8 の折損を防止することが出来る。

また、上記二重被覆の外表面、本実施例では被覆 16 の外表面に、二硫化モリブデン、シリコン、テフロン等の表面潤滑剤を塗布したものは、弯曲時に他の内蔵物との摩擦が軽減され、挿入部 A 内での移動が円滑になり、弯曲時の経路変化に対しても極めて容易に追従できる。

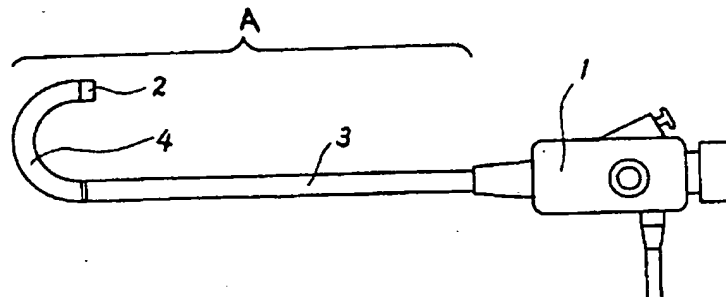
上述の如く本考案に係る内視鏡によれば、克く所期の目的を達成するものであり、実用上裨益するところが多大である。

図面の簡単な説明

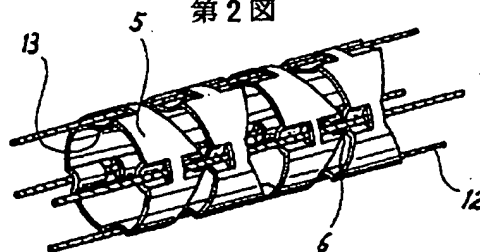
第 1 図は一般的な内視鏡の概観図、第 2 図は内視鏡の弯曲部の構成を示す斜視図、第 3 図は弯曲時の硬いチューブによる光学繊維束の圧迫状態を示す断面図、第 4 図は内蔵物の配置例を示す断面図、第 5 図は本考案実施例の内視鏡の光学繊維束を示す一部縦断側面である。

1……操作部、4……弯曲部、7……像伝達用光学繊維束、8……照明用光学繊維束、15……可撓性薄肉チューブ、16……被覆層。

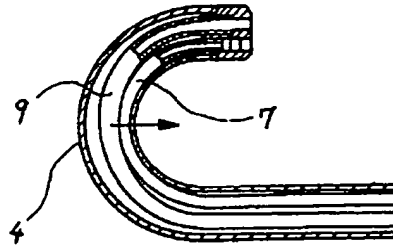
第 1 図



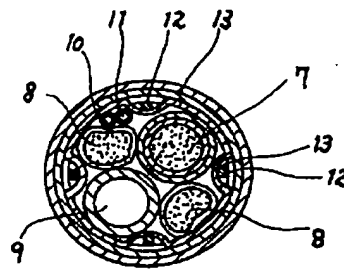
第 2 図



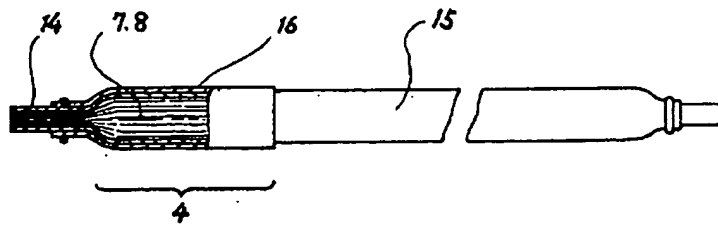
第3図



第4図



第5図



Date: February 13, 2002

Declaration

I, Michihiko Matsuba, President of Fukuyama Sangyo Honyaku Center, Ltd., of 16-3, 2-chome, Nogami-cho, Fukuyama, Japan, do solemnly and sincerely declare that I understand well both the Japanese and English languages and that the attached document in English is a full and faithful translation, of the copy of Japanese Utility Model Publication No. Sho-63-48243 published on December 13, 1988.

A handwritten signature in black ink, appearing to read "m. matsuba". The signature is fluid and cursive, with the first letter of "matsuba" being a large, stylized "m".

Michihiko Matsuba

Fukuyama Sangyo Honyaku Center, Ltd.

AN ENDOCSOPE

Japanese Utility Model Publication No. Sho-63-48243

Published on: December 13, 1988

Application No. Sho-57-15546

Filed on: February 6, 1982

Inventor: Teruo OUCHI, et al.

Applicant: Medosu Research Center

Patent Attorney: Satoru YOSHIMURA

SPECIFICATION

[TITLE OF THE UTILITY MODEL] AN ENDOCSOPE

[WHAT IS CLAIMED IS:]

An endoscope provided with an inserting portion A of comparable length containing a tip end 2 and adjacent curvature portion 4 and optical fiber bundles of which each bundle is coated by a thin-walled tube and is arranged so that it is adopted for being inserted into the curvature portion 4, wherein another film of synthetic material is partially over-coated on each of the outer surfaces of the thin-walled tubes in a close contact relationship corresponding to the length within a curvature portion 4.

[DETAILED DESCRIPTION OF THE UTILITY MODEL]

The present utility model is related to an endoscope in which occurrence of breaks and damage of a bundle of optical fibers disposed within a curvature of an inserting portion of the endoscope to be inserted into a body cavity are reduced.

A medical endoscope is required to alleviate the pain of a patient caused by insertion of the endoscope into a patient's body cavity as much as possible. Consequently, lessening the outer diameter of an inserting portion is desirable even if its degree is on the order of 0.1 mm, for example. It is, therefore, also true that a finer bundle of optical fibers is desirable for disposing the bundle within the inserting portion of the endoscope, but a limitation exists in the reduction of a fiber bundle diameter as its observation sight should be ensured. For this reason an even thinner outer sheath is required.

The prior arts are explained by way of the drawings. In the conventional inserting portion of an endoscope a flexible thin-walled tube 15 of approximately 0.1 to 0.2 mm in thickness made of silicone, rubber or other plastic materials have been used for the outer sheath (refer to Fig. 5). On the other hand, within the inserting portion A having an outer diameter which has been reduced to reach its limit there are provided optical

fiber bundles 7 and 8, a channel 9 for inserting biopsy testing instrument such as forceps and the like, respective channels 10 and 11 for supplying air and water, and a guide wire 12 for operating a curvature portion to form a curved configuration at the tip-end of the inserting portion of the endoscope. As described above various kinds of components are disposed very closely within a limited space in the inserting portion A and, as a result, a phenomenon is observed in that the housed components including the bundle of optical fibers tend to shift slidably within both the flexible tube 3 and the curvature portion 4 each time the curvature portion 4 at the tip-end shifts in a curved form and are mutually compressed repeatedly.

As shown in Fig. 2 the curvature portion 4 of an endoscope is structured in a manner that a plurality of short tubes 5 are connected by caulking pins 6 or the like consecutively and the guide wire 12, which is used for operating the curvature portion 4 to form a curved configuration, is passed through the wire insertion channels 13 formed in the peripheries of the short tubes 5. As the central longitudinal axis of the curvature lies on the center line of the curvature portion 4 the pathways of the components within the curvature portion 4 are shortened at its inner peripheral side which corresponds to the nearer side to the center of the curvature upon

operational movement in a curved form. On the contrary, on the more distant side from the center of the curvature, which is the outer peripheral side, the pathways become longer. This indicates that in the curvature portion 4 the components located nearer to the central axis of the curvature are subjected to compression, while those located distant from the axis are extended. The compressed housed components shift toward their outer peripheral sides which provide longer pathways or shift in a direction of an operational portion. On the other hand, those being extended shift toward their inner side having shorter pathways providing compressive forces on the other group of housed components located in the inner side of the curvature portion. In particular, the rigid tube(s) such as channel 9, which is intended for use in inserting biopsy testing instruments and is made of a rigid tube, is difficult to bend and tends to retain or restore to its original almost linear configuration(s) and shifts in the direction shown by the arrow in Fig. 3. This movement likely causes compression on optical fiber bundles 7 and 8. Further, each of the components located in the inner periphery in the curvature portion 4 frictionally slide since their distances from the central axis of the curvature differ individually causing uneven transfer from their original locations.

As described above optical fiber bundles receive various forces of compression, extending or constraining. Under these circumstances mere changes in pathways for optical fiber bundles in order to mitigate a compression force will not always be an effective means as it will adversely affect other inner components by increasing constraint forces. To mitigate the restraining forces it is most desirable to provide the optical fiber bundles with the capability to shift in the direction of the operating portion 1. However, when the above described inner components shift through the inner wall of the inserting portion A there are frictional forces that total from 50 to 200 g working between the shifting components and the inner wall of the insertion portion A and also between the mutually shifting components as well. It is, therefore, apparent that the components do not retreat toward the operational portion 1 unless they are pushed by a force overcoming these frictional forces. Furthermore, if the optical fiber bundles are curved in either the left or right direction, or made to buckle by pushing, then the pushing force cannot be transmitted and consequently they become immovable.

An optical fiber bundle with a sheath of a thin-walled tube 15 strength against a force perpendicular to the longitudinal axial direction is insufficient and is, so called,

weak-kneed and this causes the tube 15 to be occasionally damaged upon constraining or breaking upon compression. As a result the optical fiber bundles are broken and bent within the curvature portion 4 and meander along in an S shape and even an individual optical fiber which forms an optical fiber bundle may be broken.

In order to protect optical fiber bundles from damage there is a method wherein optical fiber bundles positioned in the curvature portion 4 at the tip-end of the inserting portion were further covered by a thin spiral tube which was disposed over the sheath of thin-walled tube 15 made of a flexible material such as silicone or the like. In this method, however, an inwardly protruding portion of the guide wire extending out of the wire insertion channel 13 sometimes fell into gaps in the spiral tube which protects the optical fiber bundle(s) and broke the optical fiber. In another case there was a malfunction wherein the edge portion of the spiral tube severed other housed components such as air and/or water supply tubes 10 and/or 11 after repeated contact. Still further the spiral tube is readily entangled by the edges of the short tubes 5 or by insertion channels 13 causing an increase in resistance to insertion of optical fiber bundles 7 and 8. Consequently, the optical fiber bundles 7 and 8 become immovable as they are not

capable of withstanding any further pushing force in order to allow a retreat toward operational portion 1 upon curvature. Accordingly the optical fiber bundles move gradually toward the tip end 2 of the inserting portion A in the exact manner drawn each time when operated and the fiber bundles tend to become more susceptible to compression within the curvature portion and meander along in an S shape resulting in damage to the optical fiber bundles 7 and/or 8.

The present utility model has been made in order to solve the above problems and an (improved) endoscope is provided in which the occurrence of damage to optical fiber bundles due to breaking is reduced without sacrificing insertion capability of the inserting portion A of the endoscope.

The structure of the present utility model is described in more detail according to the preferred embodiments shown in the attached drawings below.

Fig.1 shows a schematic view of a commonly used endoscope. An operational portion is designated by reference numeral 1 and an inserting portion which is inserted into a body cavity is designated by character A. The inserting portion A is composed of a tip end 2, a curvature portion 4 and a flexible tube 3. An insertion tube in the curvature portion 4 is configured, as shown in Fig. 2, so that a plurality of short

tubes 5 having trimmed surfaces on both sides are consecutively connected by caulking pins 6 in a manner wherein the tube can be flexibly bent. As shown in Fig.4 a variety of components are inserted into the curvature portion 4 including an optical fiber bundle 7 for image signal transmission and another optical fiber bundle 8 for illuminating an object in the body, a channel 9 for inserting biopsy testing instruments, a channel 10 for supplying air and also a channel 11 for water supply and a guide wire 12 for making the curvature portion 4 in a pre-determined curved form.

As shown in Fig. 5 the optical fiber bundle 7 for image signal transmission and optical fiber bundle 8 for illuminating an object in the body are stationarily attached to metal fittings 14 at both ends. Both of the middle portions of the optical fiber bundles 7 and 8 are covered respectively by flexible thin-walled tubes 15 made of a flexible material such as silicone, rubber or plastic or the like, and both ends of the tubes 15 are also stationarily attached to the metal fittings 14 either by tightening the end portions with thread or by adhesion.

In the endoscope according to the present utility model the parts of the optical fiber bundles corresponding to the curvature portion 4 of the endoscope are further overlaid by

layers of synthetic resin or synthetic rubber or the like above the thin-walled tubes 15. This duplicating in the protective structure increases the covering thickness and enhances rigidity in only the curvature portion. The method for making such a protective film includes a dip-coating of an emulsion type synthetic rubber or synthetic resin so that a crosslinked coating film or a coagulated film is provided over the thin-walled tube, and a die-coating of a synthetic resin in a paste form to obtain a coagulated film with an even film thickness. As an alternative to the above embodiment in which the coated layer 16 is overlaid onto the thin-walled tube 15 along its entire length the coated layer 16 may be partially formed on the part of the optical fiber bundle corresponding to the curvature portion 4 and then the thin-walled tube 15 is disposed covering the entire length of the optical fiber bundle. Further, a lubricating agent such as molybdenum disulfide, silicone (oil) and Teflon^R (powder) can be applied over the surfaces of the above-treated optical fiber bundles so that the optical fiber bundles are able to proceed smoothly in response to changes in pathways during curvature operation since resistance to shifts in pathways due to mutual friction between co-housed components is reduced. Thus the optical fiber bundles will not be made to buckle and the problem of

gradual bending in a S shape form can be restrained. The above described application of the lubricating agent is particularly effective in mitigating friction in the curvature portion where a severe curvature is expected, although it is also effective in other portions where friction between co-housed components is expected. This advantageous feature brought about by application of a lubricating agent is more remarkably produced when utilized in association with a duplication of protective covering.

According to the endoscope having the above described specific configuration the tube 15 covering the entire length of optical fiber bundles 7 or 8 is thin in thickness and the other coating layer 16 made of synthetic resin or synthetic rubber is overlaid solely on the part of each of the bundles 7 and 8 corresponding to the curvature portion 4 of the endoscope. There are no adverse effects in ability to insert the insertion portion A into a body cavity since the outside diameter in almost all longitudinal dimensions of the insertion portion A is kept unchanged in comparison with that of a conventional endoscopic device. Further, the partially increased wall-thickness in the curvature portion 4 provides increased rigidity and enhanced resistance to external pressures. Additionally the curvature portion 4 can withstand

restraint forces caused either by shifting of other co-housed components or by the protruding portion of guide wire 12 extending out of the wire insertion channel 13. It has become possible to transform compression force, which is generated by shifts in channels for housed components upon curving the tip-end of the inserting portion A for making the curvature portion 4, to a drive force for pushing the optical fiber bundles toward the operational portion 1. Thus the occurrence of breaking fiber bundles in the curvature portion 4 is eliminated and meandering along in an S shape can be restrained.

Application of a surface lubricating agent such as molybdenum disulfide, silicone (oil) and Teflon^R (powder) on the surface of the duplicated coatings, i. e., on the surface of coating 16 in the preferred embodiment, and friction with other co-housed components upon curvature is mitigated and hence their movement within the inserting portion A becomes smooth and the fiber bundles can readily follow the shifts in pathways within the curvature portion upon curvature.

As described above the intended objectives have been achieved by an endoscope of the present utility model and various advantageous features are provided for practical uses.

[BRIEF DESCRIPTION OF THE DRAWINGS]

Fig.1 is a schematic view of a commonly used endoscope.

Fig.2 is a perspective view showing a construction of a curvature portion of an endoscope.

Fig.3 is a cross-sectional view showing a state of compression of optical fiber bundles when covered by a rigid tube.

Fig.4 is a cross-sectional view showing an arrangement of inserted components.

Fig.5 is a partially cross-sectional side view showing optical fiber bundles for an endoscope of preferred embodiment of the present utility model.

[Reference Numerals]

- 1 an operational portion
- 4 a curvature portion
- 7 an optical fiber bundle for image signal transmission
- 8 an optical fiber bundle for illuminating a target object
- 15 flexible thin-walled tube(s)
- 16 coating layer(s)

Fig.1

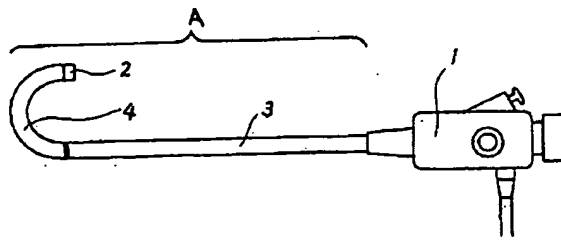


Fig.2

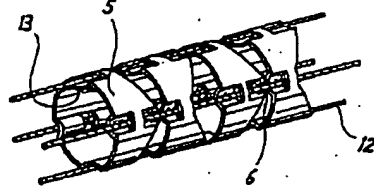


Fig.3

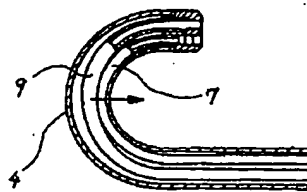


Fig.4

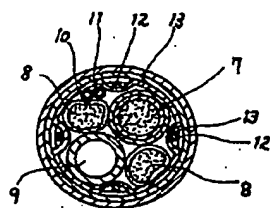


Fig.5

